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WARMINSTER, PA. 18974

REPORT NO. NADC-72159-VT

30 AUG 1972

EVALUATION OF CORROSION
INHIBITING PIGMENTS FOR ALUMINUM

PHASE REPORT

AIRTASK WF51543202
Work Unit D

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DTIC QUALITY INSPECTOR

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S U M M A R Y

INTRODUCTION

The purpose of this investigation which was performed under AIRTASK number WF51543202, Work Unit D, was to screen various inhibitors for their corrosion protection of aluminum alloys. Some of these inhibitors were evaluated because of their alleged protection of steel. A secondary objective was to find what type of chemicals or pigments afford protection for aluminum.

SUMMARY OF RESULTS

The use of inhibitors having some solubility of hexavalent chromium in the salt solution, as evidenced by the characteristic chromate ion color, resulted in very little weight loss of the aluminum coupon, and very little visible corrosion.

Materials which are insoluble in the salt solution permitted high weight losses and severe visual corrosion.

There was excellent correlation between weight losses of the aluminum coupons and their visible corrosion.

CONCLUSIONS

Pigments or chemicals which contain water soluble chromates afford the best corrosion protection for aluminum alloy. Likewise water soluble compounds such as potassium permanganate, which is also a strong oxidizing agent and deposits insoluble manganese dioxide on the aluminum surface is also satisfactory.

In screening materials for their corrosion protection of aluminum, the weight loss of the coupon plus its visual examination for corrosion is a satisfactory technique for selecting materials which will subsequently be compounded into a paint and further evaluated.

Inhibitive pigments which may be satisfactory for steel are not necessarily good inhibitors for aluminum.

RECOMMENDATIONS

a. Zinc and strontium chromates, combining as they do low cost with adequately controlled water solubility, be the only chromate pigments used for the protection of aluminum alloys.

b. The technique of immersing an aluminum coupon into a 5% salt solution containing the inhibitor, be adopted as a standard screening test because of its good correlation with more sophisticated tests.

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E V A L U A T I O N A N D D I S C U S S I O N

BACKGROUND

The fastener areas, edges of seams, areas where the paint has flaked and other bare aluminum areas on naval aircraft are corrosion prone because they are frequently in contact with salt water as well as sulfur dioxide and particulate matter from smoke stacks. The purpose of this assignment was to screen various inhibitors, some of which are used to protect steel. If the screening test showed other commercially available pigments to be equal or superior to the presently used strontium chromate, then appropriate primers would be made and further evaluated.

DEVELOPMENT OF METHODS AND RESULTS

Coupons, 2 in. X 2 in. X .020 in. were cut from 7075T6 aluminum alloy. The coupons were cleaned with acetone, weighed and suspended with a string in a glass jar containing 5% sodium chloride solution and 0.10% of the inhibitor and capped. The coupons were suspended in the inhibitor/salt solution for 21 days. They were then removed, rinsed in distilled water, dried and weighed. The coupons were examined visually for corrosion.

Table I lists the inhibitors, weight loss and appearance of the coupons after immersion in the salt solution. Figures I to III are photographs of the suspended specimens.

T A B L E I

CORROSION EVALUATION OF VARIOUS INHIBITORS
IMMERSED IN 5% SALT SOLUTION FOR 21 DAYS

| <u>INHIBITOR, 0.10% (1,000 PPM)</u> | <u>AVERAGE WEIGHT</u> (Gain or Loss) | <u>APPEARANCE</u> |
|-------------------------------------|---|--------------------|
| Strontium Chromate | - 2.0 Mg. | No corrosion |
| Strontium Molybdate | - 33.1 Mg. | Severe corrosion |
| Zinc Molybdate | - 4.7 Mg. | Moderate corrosion |
| Zinc Phosphate | - 17.9 Mg. | Severe corrosion |
| Aluminum Phosphate | - 37.1 Mg. | Severe corrosion |
| Potassium Chromate | - 1.3 Mg. | No corrosion |
| Potassium Permanganate | - 3.9 Mg. | Slight corrosion |
| Chromium Chromate | + 2.5 Mg. | Slight corrosion |
| Cadmium Phosphate Chromate | + 4.5 Mg. | Slight corrosion |



Figure 1. - 7075-Aluminum Alloy Specimen Suspended in 5% Salt Solution Containing 0.1% Inhibitor



Figure 2. - 7075-Aluminum Alloy Specimen Suspended in 5% Salt Solution Containing 0.1% Inhibitor



Figure 3. - 7075-Aluminum Alloy Specimen Suspended in 0.1% Inhibitor 5% Salt Solution Containing 0.1% Inhibitor

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